Trend Study 2-31-01

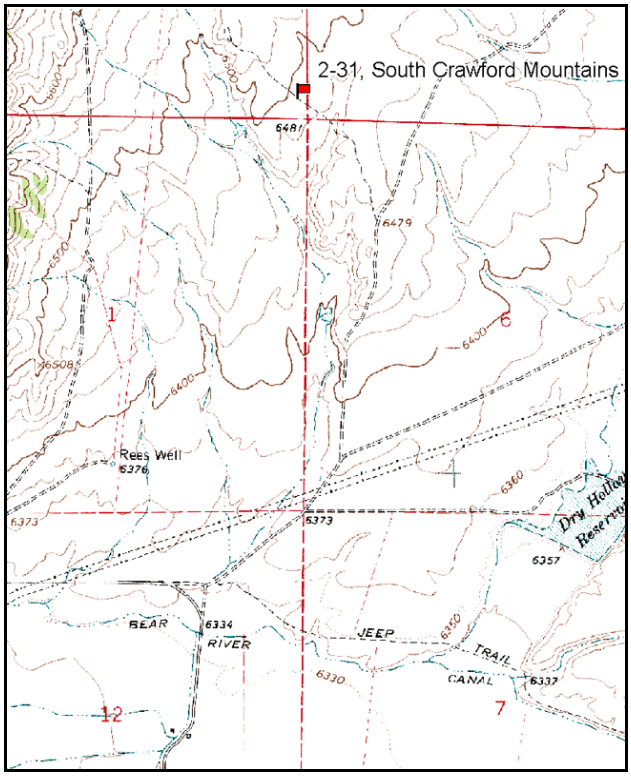
Study site name: South Crawford Mountains . Vegetation type: Big Sagebrush .

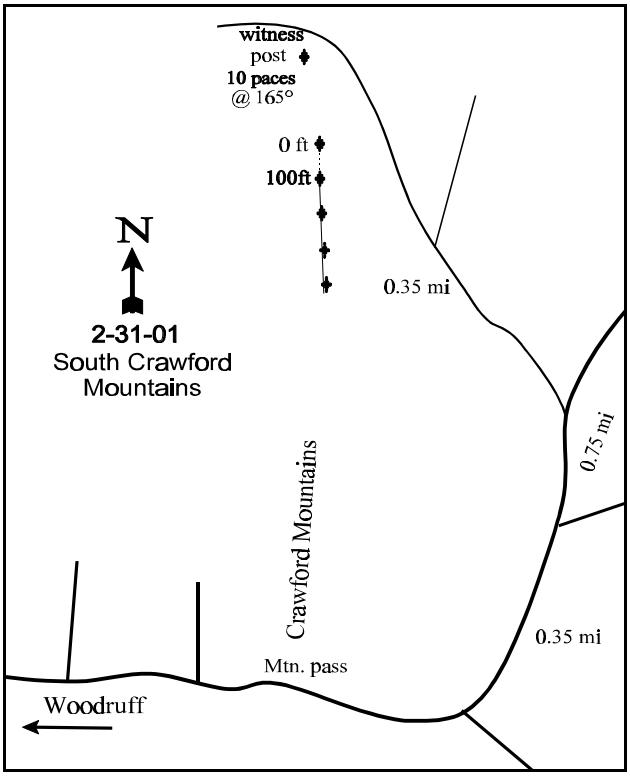
Compass bearing: frequency baseline 165 degrees magnetic.

Frequency belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft).

LOCATION DESCRIPTION

From the intersection of Wilson Lane and Little Crawford Road east of Woodruff proceed east 1.6 miles through the small pass to the east side of the mountains. Take the left fork and travel northeast for 0.35 miles. Turn left here and proceed northeast for 0.75 miles. At this point, turn left onto a lightly used jeep trail and travel northwest for an additional 0.35 miles to a witness post on the left hand side of the road. From the witness post walk 10 paces at 165 degrees magnetic to the 0-foot baseline stake of the baseline. The baseline is marked by browse tag #7940.





Map Name: Woodruff Narrows

Diagrammatic Sketch

Township 10N , Range 7E , Section 36

UTM 4600223 N, 492408 E

DISCUSSION

Trend Study No. 2-31

The South Crawford Mountains trend study samples the Wyoming big sagebrush type. The site is nearly level and has an elevation of 6,500 feet with a slight east aspect. An important wildlife area, this area helps sustain deer and elk in the winter. It is also used intermittently year-round by pronghorn and sage grouse. Cattle graze the area in spring and summer, and were present during the 1996 reading. Quadrat frequency of deer pellet groups was moderately high at 31% in 1996. Elk pellet groups were rare. A deer antler drop was also found on site. A pellet group transect read along the study site baseline in 2001 estimated 23 deer and 13 cow days use/acre (56 ddu/ha and 32 cdu/ha). One pronghorn antelope, 1 elk pellet group, and 3 sage grouse pellet groups were also sampled on the transect.

Soil is classified as "Woodpass Loam," a widely distributed category in this area. It is a deep, well-drained soil that forms in alluvial deposits derived from sandstone and limestone. Permeability is slow and available water capacity is high. Erosion hazard is moderate. Although the Woodpass soil is moderately to strongly alkaline and calcareous, root penetration is not inhibited (Campbell and Lacey 1982). Soil tests from the site show a sandy clay loam texture with a neutral pH (7.1) in the upper horizons. Effective rooting depth (see methods) was estimated at just over 12 inches with a rocky calcium carbonate layer starting at about 12 inches. This layer appears to limit rooting depth at the end of the baseline where black sagebrush was encountered. Potassium is low at 51.2 ppm, which could be a limiting factor for the site. Potassium values less than 70 ppm may limit plant development and growth. Exposed bare ground is common averaging 33% between 1984 and 2001. Wind and water erosion are not severe due to the gentle terrain and a uniform sagebrush cover. The erosion condition class was determined to be stable in 2001 with slight pedestalling of sagebrush the only notable sign of past soil movement.

The dominant browse is a somewhat dense and vigorous stand of Wyoming big sagebrush that receives moderate to occasional heavy use. Heavy utilization, poor vigor, and high decadence (72%) were found during the 1990 reading. In 1996, many of the decadent plants apparently regained their vigor, and percent decadency declined to 30%, which is good for a typical Wyoming big sagebrush site in this area. Dead plants, first sampled in 1996, numbered 1,300, resulting in a ratio of dead to live plants of 1:5. Seedling and young plants were extremely common in 1984, but have since declined. During the 2001 reading, no seedlings were encountered and young plants accounted for only 3% of the population. Annual leader growth appeared relatively poor averaging less than 1 inch in 2001. Few shrubs appeared to be producing seed in 1996 or 2001.

Other shrubs are of secondary importance and none appear to be increasing or decreasing in density. These species include black sagebrush, narrowleaf low rabbitbrush, slenderbush eriogonum, prickly phlox, pricklypear, and gray horsebrush,

Grasses and forbs are sparsely distributed and include a mix of species which looks about average for the Wyoming big sagebrush type in Rich County. Four perennial grass species provide the bulk of the herbaceous forage, which is supplemented by low-growing, low-value forbs. Annual plants are rare. Sandberg bluegrass is the most common perennial grass which accounted for 65% of the grass cover in 1996 and 69% in 2001. Forbs are fairly diverse for this type, yet only hoods phlox is abundant. Trend studies located within this unit on the Wyoming big sagebrush type have shown remarkable similarity in plant composition.

1984 APPARENT TREND ASSESSMENT

Our best estimate is that soil and vegetative trends are both stable. No imminent changes in soil condition, vegetative composition, or productivity are expected.

1990 TREND ASSESSMENT

Wyoming big sagebrush has declined in all measurements on this heavily used winter range. Density declined by 6%. The percentage of decadent sagebrush increased to 72% of the population, and very few young plants were counted. The sagebrush is moderately to heavily hedged and has poor vigor and low growth. Sagebrush canopy cover averages 16%. Low rabbitbrush is unchanged. Sandberg bluegrass is still very abundant, while bluebunch wheatgrass decreased significantly in nested frequency. The percentage of litter cover has concurrently declined, but there was a significant increase in the amount of cryptogamic cover. Sheet erosion and plant pedestalling are still evident.

TREND ASSESSMENT
soil - down slightly (2)
browse - down (1)
herbaceous understory - down slightly (2)

1996 TREND ASSESSMENT

Trend for soil is stable. Percent bare ground is similar to 1990 estimates. Litter cover increased, but cryptogamic cover declined 62%. Erosion is not severe due to the gentle terrain. Trend for Wyoming big sagebrush is up slightly. Total density declined 18% since 1990, but utilization is more moderate, vigor has improved, and percent decadency has declined from 72% to 30%. Young plants are more abundant this year, although seedlings are limited. Trend for the herbaceous understory is stable. Sum of nested frequency of perennial grasses has increased slightly, while frequency of forbs has declined slightly.

TREND ASSESSMENT
soil - stable (3)
browse - up slightly (4)
herbaceous understory - stable (3)

2001 TREND ASSESSMENT

Trend for soil is stable. Percent cover of bare ground has increased slightly but litter and vegetation cover increased. Erosion appears minimal and the erosion condition class was determined to be stable. Trend for the key browse species, Wyoming big sagebrush, is up slightly. Density has increased by 13%, utilization is mostly light, average vigor has improved, and percent decadence has declined from 30% to 20%. No seedlings were sampled; however, young plants account for 3% of the population. Annual leader growth appears to be poor averaging less than 1 inch. Narrowleaf low rabbitbrush appears to have a stable population of about 3,000 plants/acre. The herbaceous trend is stable with similar sum of nested frequency values for perennial grasses and forbs compared to 1996. Herbaceous production is poor with grasses producing 9% cover. Sandberg bluegrass dominates the grass composition by providing 69% of the grass cover. The forb composition is still poor and totally dominated by hoods phlox which provides 83% of the forb cover. All forbs combine to produce less than 5% cover.

TREND ASSESSMENT
soil - stable (3)
browse - up slightly (4)
herbaceous understory - stable (3)

HERBACEOUS TRENDS --
Herd unit 02 , Study no: 31

Type	Species	Nested Frequency				Quadrat Frequency				Average Cover %	
		'84	'90	'96	'01	'84	'90	'96	'01	'96	'01
G	Agropyron smithii	-	-	-	4	-	-	-	2	-	.06
G	Agropyron spicatum	$_{c}$140	$_{a}$53	$_{ab}$81	$_{b}$97	60	23	33	40	.84	1.12
G	Bromus tectorum (a)	-	-	1	-	-	-	1	-	.00	-
G	Carex spp.	$_{a}$-	$_{a}$-	$_{a}$-	$_{b}$12	-	-	-	5	-	.07
G	Oryzopsis hymenoides	$_{c}$60	$_{bc}$45	$_{a}$21	$_{ab}$30	27	24	10	15	.21	.64
G	Poa fendleriana	$_{a}$-	$_{a}$-	$_{b}$30	$_{a}$2	-	-	12	1	.50	.00
G	Poa secunda	$_{a}$231	$_{b}$275	$_{ab}$246	$_{b}$272	90	95	87	94	5.18	6.03
G	Sitanion hystrix	$_{c}$107	$_{a}$3	$_{b}$29	$_{ab}$17	53	1	14	7	.22	.13
G	Stipa comata	$_{a}$16	$_{c}$98	$_{bc}$79	$_{ab}$56	10	45	35	20	1.06	.64
Total for Annual Grasses		0	0	1	0	0	0	1	0	0.00	0
Total for Perennial Grasses		554	474	486	490	240	188	191	184	8.03	8.72
Total for Grasses		554	474	487	490	240	188	192	184	8.03	8.72
F	Agoseris glauca	1	-	-	-	1	-	-	-	-	-
F	Alyssum alyssoides (a)	-	-	$_{a}$-	$_{b}$15	-	-	-	8	-	.04
F	Antennaria rosea	$_{a}$-	$_{b}$12	$_{ab}$3	$_{a}$-	-	5	3	-	.04	-
F	Arabis drummondi	$_{b}$31	$_{a}$-	$_{a}$6	$_{a}$4	17	-	3	2	.07	.01
F	Astragalus convallarius	$_{b}$60	$_{a}$1	$_{a}$8	$_{a}$19	30	1	4	9	.04	.12
F	Astragalus utahensis	10	8	13	10	5	4	5	4	.19	.09
F	Cordylanthus ramosus (a)	-	-	$_{a}$2	$_{b}$29	-	-	2	14	.01	.27
F	Cryptantha spp.	$_{c}$80	$_{b}$40	$_{ab}$24	$_{a}$11	41	16	13	5	.19	.02
F	Draba spp. (a)	-	-	-	2	-	-	-	1	-	.00
F	Erigeron pumilus	8	-	6	2	4	-	3	1	.01	.00
F	Eriogonum umbellatum	-	-	1	1	-	-	1	1	.00	.00
F	Haplopappus acaulis	3	-	1	1	1	-	1	1	.03	.03
F	Lappula occidentalis (a)	-	-	$_{a}$-	$_{b}$31	-	-	-	16	-	.08
F	Phlox hoodii	$_{b}$220	$_{b}$200	$_{a}$153	$_{b}$180	87	84	65	73	3.00	3.80
F	Phlox longifolia	-	-	8	2	-	-	3	2	.01	.01
F	Tragopogon dubius	4	-	-	-	2	-	-	-	-	-
F	Trifolium spp.	$_{c}$26	$_{ab}$2	$_{a}$-	$_{bc}$15	13	1	-	7	-	.06
Total for Annual Forbs		0	0	2	77	0	0	2	39	0.00	0.39
Total for Perennial Forbs		443	263	223	245	201	111	101	105	3.61	4.17
Total for Forbs		443	263	225	322	201	111	103	144	3.62	4.57

Values with different subscript letters are significantly different at alpha = 0.10 (annuals excluded)

BROWSE TRENDS --
Herd unit 02 , Study no: 31

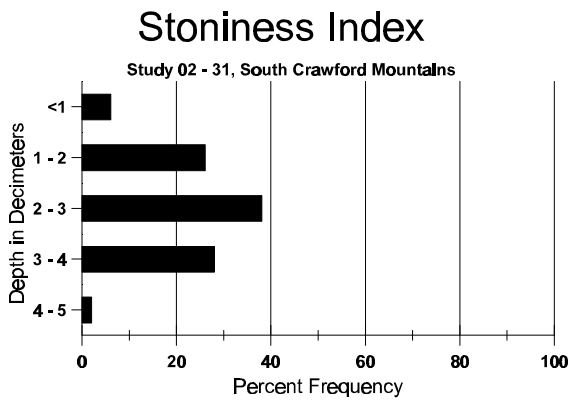
Type	Species	Strip Frequency '96	Strip Frequency '01	Average Cover % '96	Average Cover % '01
B	Artemisia nova	7	7	.19	1.24
B	Artemisia tridentata wyomingensis	98	98	16.34	20.70
B	Chrysothamnus viscidiflorus stenophyllus	70	62	1.77	1.83
B	Eriogonum microthecum	23	15	.29	.34
B	Leptodactylon pungens	14	11	.24	.19
B	Opuntia spp.	4	5	.03	-
B	Tetradymia canescens	1	1	-	-
Total for Browse		217	199	18.87	24.31

BASIC COVER --
Herd unit 02 , Study no: 31

Cover Type	Nested Frequency '96	Nested Frequency '01	Average Cover % '84	Average Cover % '90	Average Cover % '96	Average Cover % '01
Vegetation	325	333	9.25	9.75	29.03	37.43
Rock	68	26	.25	.75	1.10	.13
Pavement	275	241	8.00	3.00	7.37	2.61
Litter	391	377	52.25	26.00	30.34	34.68
Cryptogams	241	207	5.00	25.25	9.66	7.50
Bare Ground	316	317	25.25	35.25	32.97	37.84

SOIL ANALYSIS DATA --
Herd Unit 02, Study no: 31, South Crawford Mountains

Effective rooting depth (in)	Temp °F (depth)	PH	%sand	%silt	%clay	%0M	PPM P	PPM K	dS/m
12.5	57.8 (13.0)	7.1	55.3	17.4	27.4	1.9	160.3	51.2	.6



PELLET GROUP FREQUENCY --
Herd unit 02 , Study no: 31

Type	Quadrat Frequency		Pellet Transect	
	'96	'01	Pellet Groups per Acre '01	Days Use per Acre (ha) '01
Rabbit	3	7	26	N/A
Grouse	-	2	26	N/A
Elk	2	-	9	<1 (2)
Deer	31	13	296	23 (56)
Cattle	1	1	157	13 (32)

BROWSE CHARACTERISTICS --
Herd unit 02 , Study no: 31

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Artemisia nova																		
Y	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
	01	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
M	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	96	13	1	-	-	-	-	-	-	-	14	-	-	-	280	9	14	14
	01	1	19	-	-	-	-	-	-	-	20	-	-	-	400	12	16	20
D	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	1	-	-	-	-	-	-	-	-	-	-	-	1	20			1
	01	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
X	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	40			2
	01	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'84	00%	00%	00%	
'90	00%	00%	00%	
'96	06%	00%	06%	+27%
'01	86%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings)			Dec:
'84	0		0%
'90	0		0%
'96	320		6%
'01	440		5%

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Artemisia tridentata wyomingensis																		
S	84	35	-	-	-	-	-	-	-	-	35	-	-	-	2333			35
	90	1	-	-	-	-	-	-	-	-	1	-	-	-	66			1
	96	2	-	-	-	-	-	-	-	-	2	-	-	-	40			2
	01	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
Y	84	8	10	2	-	-	-	-	-	-	20	-	-	-	1333			20
	90	1	1	-	-	-	-	-	-	-	2	-	-	-	133			2
	96	14	4	-	-	-	-	-	-	-	17	-	-	1	360			18
	01	10	-	-	2	-	-	-	-	-	12	-	-	-	240			12
M	84	-	60	18	-	-	-	-	-	-	78	-	-	-	5200	14	21	78
	90	4	10	17	-	-	-	-	-	-	19	-	12	-	2066	12	19	31
	96	68	140	-	-	-	-	-	-	-	208	-	-	-	4160	15	27	208
	01	216	55	10	-	4	-	-	-	-	273	12	-	-	5700	16	25	285
D	84	-	14	12	-	-	-	-	-	-	20	-	4	2	1733			26
	90	6	48	30	-	-	-	-	-	-	37	-	29	18	5600			84
	96	23	58	13	-	1	-	-	-	-	60	-	-	35	1900			95
	01	48	25	1	-	-	-	-	-	-	47	-	-	27	1480			74
X	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	1300			65
	01	-	-	-	-	-	-	-	-	-	-	-	-	-	1140			57

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'84	68%	26%	05%	- 6%
'90	50%	40%	50%	-18%
'96	63%	04%	11%	+13%
'01	23%	03%	07%	

Total Plants/Acre (excluding Dead & Seedlings)				
	'84	8266	Dec:	21%
	'90	7799		72%
	'96	6420		30%
	'01	7420		20%

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Chrysothamnus viscidiflorus stenophyllus																		
Y	84	10	2	-	-	-	-	-	-	-	12	-	-	-	800			12
	90	10	-	-	-	-	-	-	-	-	10	-	-	-	666			10
	96	7	-	-	-	-	-	-	-	-	7	-	-	-	140			7
	01	1	-	-	-	-	-	1	-	-	2	-	-	-	40			2
M	84	51	40	-	-	-	-	-	-	-	91	-	-	-	6066	9	12	91
	90	13	14	8	2	1	-	-	-	-	37	-	1	-	2533	6	6	38
	96	85	3	9	23	-	-	-	-	-	115	-	-	5	2400	9	11	120
	01	111	6	3	5	2	-	3	-	-	126	4	-	-	2600	8	10	130
D	84	-	2	-	-	-	-	-	-	-	2	-	-	-	133			2
	90	20	19	6	3	1	-	-	-	-	30	-	7	12	3266			49
	96	15	1	1	-	-	-	-	-	-	9	-	-	8	340			17
	01	15	-	-	-	-	-	-	-	-	9	-	-	6	300			15
X	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	20			1
	01	-	-	-	-	-	-	-	-	-	-	-	-	-	40			2

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'84	42%	00%	00%	- 8%
'90	36%	14%	21%	-55%
'96	03%	07%	09%	+ 2%
'01	05%	02%	04%	

Total Plants/Acre (excluding Dead & Seedlings)				
'84	6999	Dec:		2%
'90	6465			51%
'96	2880			12%
'01	2940			10%

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Eriogonum microthecum																		
Y	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	1	-	-	1	-	-	-	-	-	2	-	-	-	133			2
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	01	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
M	84	2	3	-	-	-	-	-	-	-	5	-	-	-	333	5	8	5
	90	5	3	1	-	-	-	-	-	-	9	-	-	-	600	5	7	9
	96	33	-	-	1	-	-	-	-	-	34	-	-	-	680	6	9	34
	01	23	-	-	2	-	-	-	-	-	23	2	-	-	500	4	7	25
D	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
	01	1	1	-	-	-	-	-	-	-	2	-	-	-	40			2

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'84	60%	00%	00%	+55%
'90	27%	09%	00%	- 5%
'96	00%	00%	00%	-23%
'01	04%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings)				
'84	333	Dec:		0%
'90	733			0%
'96	700			3%
'01	540			7%

Leptodactylon pungens																		
M	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	96	18	-	-	1	-	-	-	-	-	19	-	-	-	380	6	12	19
	01	20	-	-	-	-	-	-	-	-	20	-	-	-	400	4	9	20
D	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	2	-	-	-	-	-	-	-	-	-	-	-	2	133			2
	96	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
	01	2	-	-	-	-	-	-	-	-	2	-	-	-	40			2

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'84	00%	00%	00%	
'90	00%	00%	100%	+67%
'96	00%	00%	00%	+ 9%
'01	00%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings)			
'84	0	Dec:	0%
'90	133		100%
'96	400		5%
'01	440		9%

AGE	YR	Form Class (No. of Plants) 1	2	3	4	5	6	7	8	9	Vigor Class 1	2	3	4	Plants Per Acre	Average (inches) Ht.	Cr.	Total
Opuntia spp.																		
Y	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	7	-	-	-	-	-	-	-	-	7	-	-	-	466			7
	96	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	01	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
M	84	4	-	-	-	-	-	-	-	-	4	-	-	-	266	4	5	4
	90	-	-	-	1	-	-	-	-	-	1	-	-	-	66	3	6	1
	96	3	-	-	-	-	-	-	-	-	3	-	-	-	60	4	12	3
	01	5	-	-	-	-	-	-	-	-	5	-	-	-	100	3	10	5
D	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0
	96	1	-	-	-	-	-	-	-	-	1	-	-	-	20			1
	01	-	-	-	-	-	-	-	-	-	-	-	-	-	0			0

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'84	00%	00%	00%	+50%
'90	00%	00%	00%	-85%
'96	00%	00%	00%	+20%
'01	00%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings)				
	'84	266	Dec:	0%
	'90	532		0%
	'96	80		25%
	'01	100		0%

Tetradymia canescens

M	84	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	90	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	0
	96	1	-	-	-	-	-	-	-	-	1	-	-	-	20	4	9	1
	01	1	-	-	-	-	-	-	-	-	1	-	-	-	20	3	13	1

% Plants Showing	Moderate Use	Heavy Use	Poor Vigor	%Change
'84	00%	00%	00%	
'90	00%	00%	00%	
'96	00%	00%	00%	+ 0%
'01	00%	00%	00%	

Total Plants/Acre (excluding Dead & Seedlings)				
	'84	0	Dec:	-
	'90	0		-
	'96	20		-
	'01	20		-